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New Filter Technique Improves Home Television Reception

Based upon theoretical reasoning, a program was undertaken to study and design combline filters and to analyze their effectiveness in improving TV signal quality. A television signal has a large portion of its transmitted energy at multiples of the line-scanning frequency, with little energy in between; i.e., the energy spectrum is roughly analogous to the teeth of a comb. If a filter consisting of passbands and stopbands congruent with the comb shape of the TV signal could be constructed, the noise-filled empty space could be filtered out and the energy-filled portion passed through, with a subsequent improvement in the signal-to-noise ratio (SNR). Further, if a combline filter were used as the filter in a phase-lock loop (PLL) demodulator, the effective loop-noise bandwidth would be reduced and the threshold would be improved; in other words, the loop would operate more efficiently and the demodulator would produce usable signals at an input SNR several dB below that of a PLL demodulator without the filter.

After investigating a variety of combline filter techniques, a PLL demodulator with the combline filter as the loop filter was built and analyzed. A 16 dB threshold improvement and a 7 dB signal-to-noise ratio improvement above threshold was achieved when compared with a first-order PLL measured for tone modulation and narrowband additive RF noise. The expected tracking problems were encountered for TV signals due to low loop gain requirements, but methods for improvement were conceived and implemented. Despite the problems encountered, a combline phase-lock loop provides significant sensitivity improvement above and below threshold.

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.95)

Reference:
NASA-CR-108506 (N70-34526), The Combline Filter and Phase-Lock Loop, A New Technique to Improve FM Television Reception

Patent status:

No patent action is contemplated by NASA.

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Category 02